73rd MORSS CD Cover Page

712CD

For office use only 41205

UNCLASSIFIED DISCLOSURE FORM CD Presentation

21-23 June 2005, at US Military Academy, West Point, NY

Please complete this form 712CD as your cover page to your electronic briefing submission to the MORSS CD. Do not fax to the MORS office.

Author Request **(To be completed by applicant) - The following author(s) request authority to disclose the following presentation in the MORSS Final Report, for inclusion on the MORSS CD and/or posting on the MORS web site.**

Name of Principal Author and all other author(s): Mr. William Maillard

Principal Author's Organization and address:

The Aerospace Corporation
El Segundo California 90245-4691

Phone:_____310-336-5033_____

Fax:_____

Email:_jack.jackson.ctr@pentagon.af.mil

Original title on 712 A/B: Investigation of advanced ISR and Weapon Systems in Missions against TBM Targets Employing Deceptive Tactics _____

Revised title: Investigation of CONOPS for ISR and Weapon Systems in Missions against Targets Employing Deceptive Tactics

Presented in (input and Bold one): (WG__5, CG___, Special Session ___, Poster, Demo, or Tutorial):

This presentation is believed to be:

UNCLASSIFIED AND APPROVED FOR PUBLIC RELEASE

THE AEROSPACE CORPORATION

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 JUN 2005	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Investigation of CONOPS for ISR and Weapon Systems in Missions against Targets Employing Deceptive Tactics	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **The Aerospace Corporation**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM201946, Military Operations Research Society Symposium (73rd) Held in West Point, NY on 21-23 June 2005. , The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**32**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Investigation of CONOPS for ISR and Weapon Systems in Missions against Targets Employing Deceptive Tactics

W. Maillard

The Aerospace Corporation

June 2005

Study Objectives

- Survey Concealment, Camouflage and Deception (CCD) techniques and approaches to modeling them
- Represent characteristics and first order effects of CCD techniques in the SEAS theater level model
- Support training in Military Utility Analysis methods and tools as part of IR&D project

- Investigate the potential contributions of advanced ISR and weapon systems to the engagement of TBM target elements employing CCD tactics

Survey of CCD Techniques

Survivability Moves

- Summary of tactic
  - Move units to new locations frequently and covertly
  - Disrupt Blue targeting process
- Modeling of tactic in SEAS
  - Code Red units and agents with orders to move periodically in some specified or reactive manner
  - Differentiate detection probability of sensors against targets in open, in hide, or on the move
- Metrics:
  - Detection rate and engagement rate

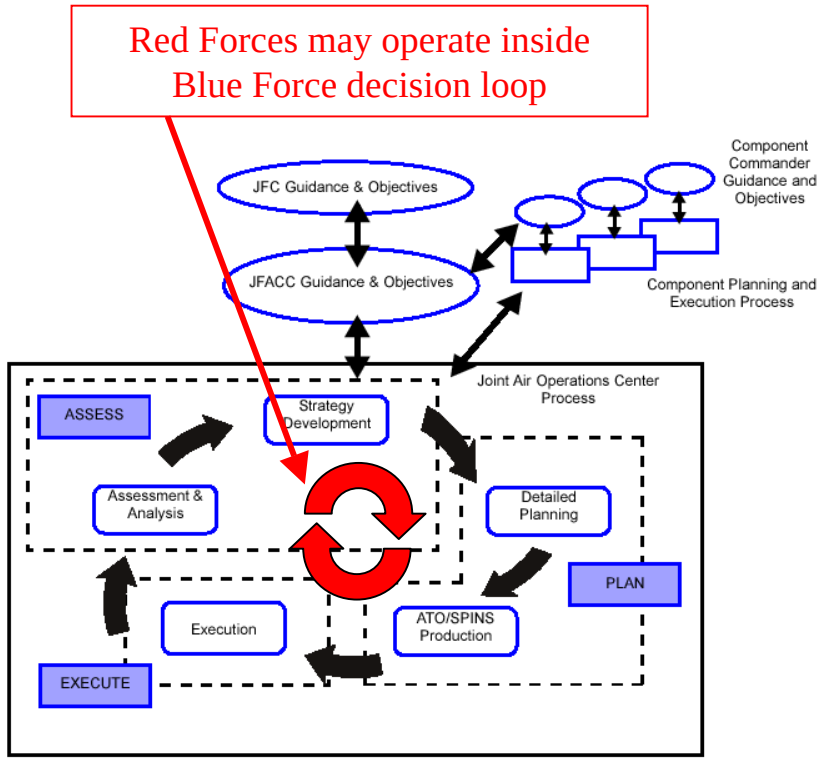


Figure 5.2. The Aerospace Assessment, Planning, and Execution Process

Air Force Doctrine Document 2, "Organization and Employment of Aerospace Power", 17 Feb 2000 (courtesy of USAF)

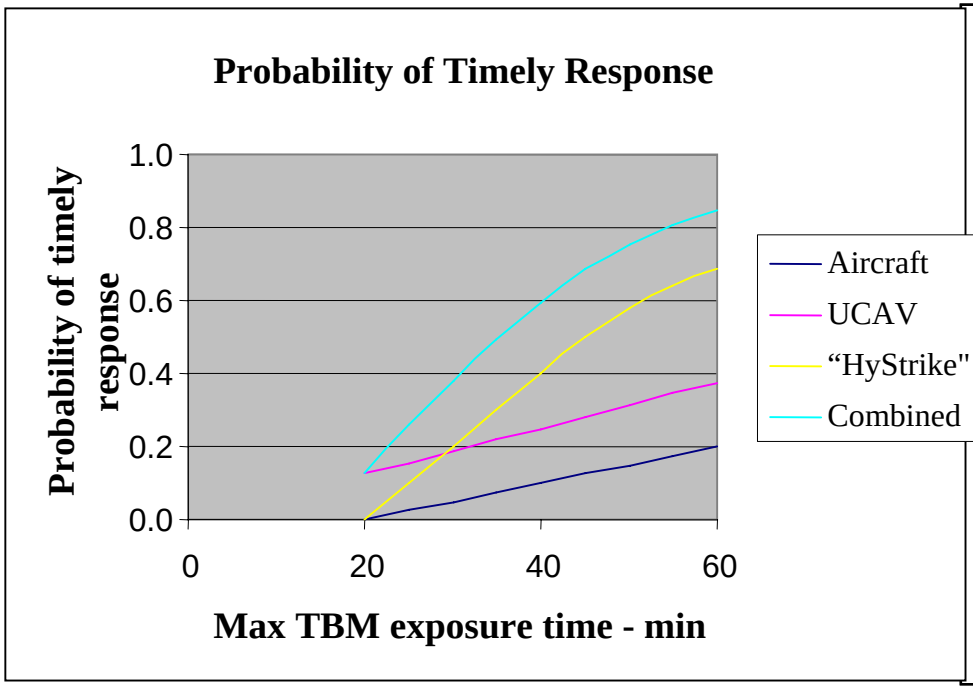
Reduce Cycle Times

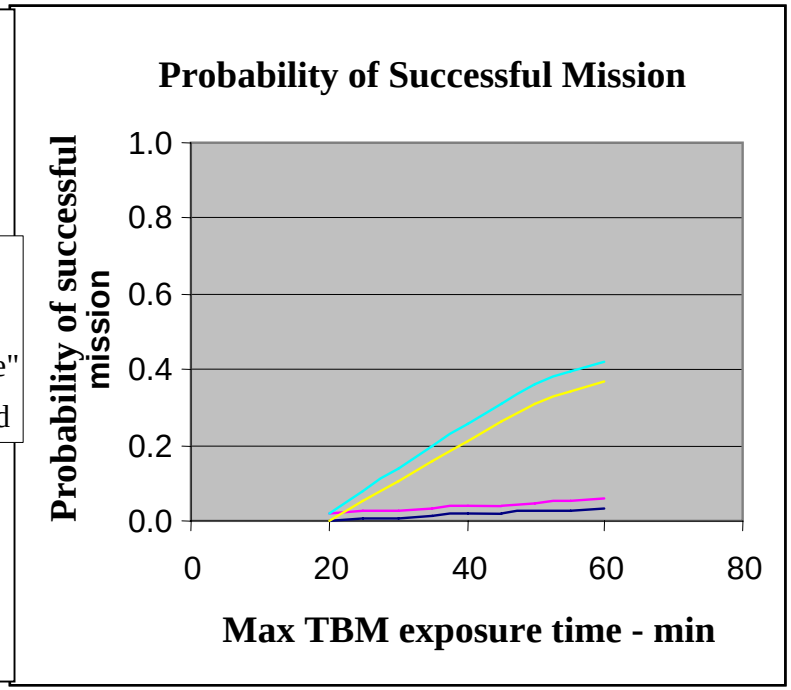
- Summary of tactic
  - Minimize time required to conduct operations and for movement cycles
  - Decrease vulnerability by limiting exposures within sensor-to-shooter timeline
- Modeling of tactic in SEAS
  - Decrease timelines for setup, teardown, and movement for selected units
  - Shorten move distances to next hide
- Metrics
  - Rate of detection, engagement, and kill vs. these targets
  - Loss in effectiveness of these targets (if any)

Trained TBM crews can significantly reduce launch preparation and move times time

DoD photo by Petty Officer 1st Class Stephen Batiz, U.S. Navy.
(photo courtesy of USAF, www.af.mil)

Parametric Look at Counter-TBM Mission





Engagement of TBM TELs difficult because of short exposure cycles

Alternatives: **1) attack TBM support elements (C2, weapon supply)**
2) attack TBMs while in hide positions
3) patrol regions where TBMs last seen

Mobile Camouflage

- Summary of tactic
  - Install camouflage systems that reduce signatures while a vehicle is in motion
  - Reduce the probability of detection for valuable assets while they are mobile
- Modeling of tactic in SEAS
  - Distinguish which units can be equipped with camouflage and represent appropriate delays
  - Decrease P_D for Blue sensors operating in bands of the camouflage treatment
- Metrics
  - Detection rate against camouflaged targets
  - Rate of engagement and kill vs. there targets

Vehicle equipped with mobile camouflage

(photo courtesy of Saab/Barracuda)

Static Camouflage

- Summary of tactic
  - Install deployable camouflage systems that reduce signatures for stationary objects
  - Reduce the probability of detection for valuable assets while they are stationary
- Modeling of tactic in SEAS
  - Model use of camouflage by agents
  - Use factors to decrease P_D for Blue sensors operating in bands affected by the camouflage treatment
- Metrics
  - Time to first detection of object
  - Rate of target kill

Camouflage netting covering amphibious assault vehicle

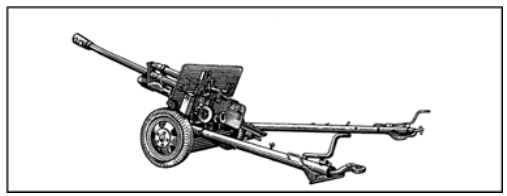
Defense Visual Information Center, Camera Operator: Gunnery Sgt. Daniel Mobley, USMC (photo courtesy of USMC, www.usmc.mil)

Decoy Operations

- Summary of tactic
  - Employ objects that realistically mimic signatures of valuable assets
  - Distract attackers away from real equipment and facilities
- Modeling of tactic in SEAS
  - Create decoy agents and employ them with tactics and behaviors similar to real objects
- Metrics
  - Probabilities of detection and identification vs. real and decoys
  - Kill ratio vs. real and decoys

DoD Report to Congress, "Kosovo/Operation Allied Force After-Action Report,"

Russian 76-mm Towed Antitank Gun ZIS-3



TRADOC DCSINT Threat Support Directorate, "OPFOR World Equipment Guide,"

DoD Report to Congress, "Kosovo/Operation Allied Force After-Action Report,"

(photos courtesy of USAF, - www.af.mil)

"The OPFOR Fighting Machines" Briefing

Battle Damage Assessment Confusion

- Summary of tactic
  - Make intact targets appear damaged or destroyed and destroyed targets appear to be repaired or undamaged.
  - Draw attacks away from undamaged equipment and facilities
- Modeling of tactic in SEAS
  - Lower the BDA probability for some sensors against targets employing these tactics
- Metrics
  - BDA success ratio
  - Rate of false attacks
  - Length of time for correct BDA and attack on undamaged target

Removal of damaged and destroyed vehicles from the battlefield can prevent accurate BDA.

(photo courtesy of USAF, www.af.mil)

Study Description

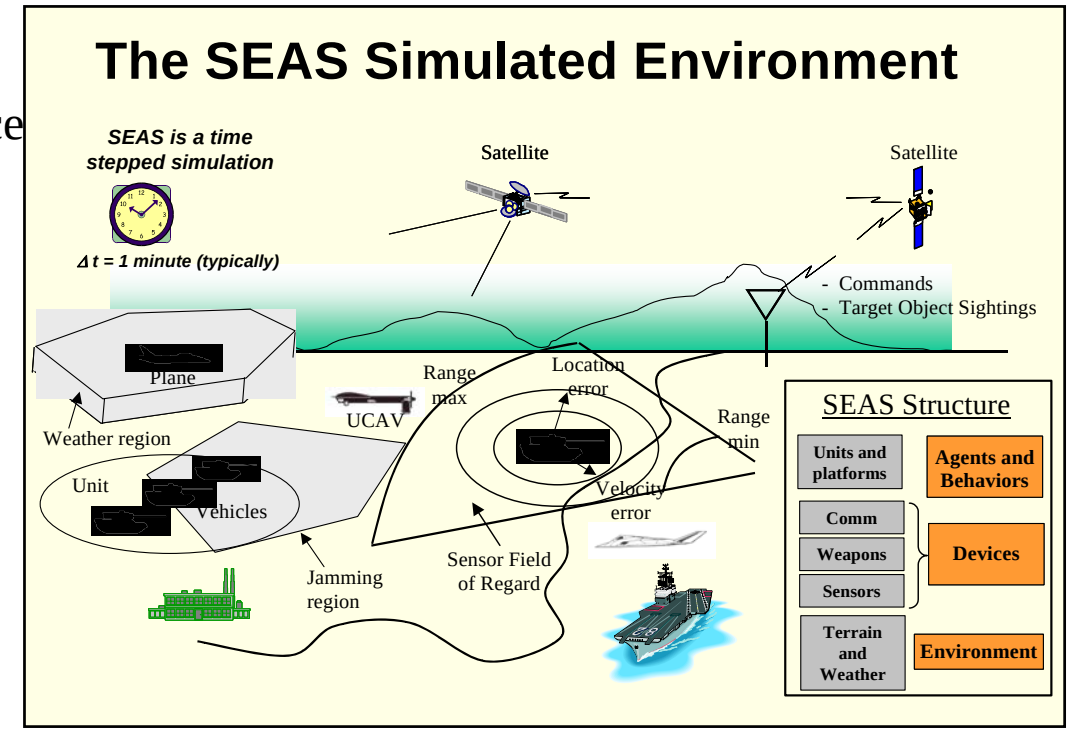
Approach

- Scenario:
  - Extensive modifications to Aerospace/SEAS contractor scenario to emphasize TBM missions and CCD usage
  - TBMs posed significant early threat to Blue air operations
- Methodology:
  - SEAS theater level campaign model with simple representation of CCD tactics
  - Parametric system performance estimates
- Metrics:
  - TBM losses (TELs, SOCs, weapon supply), ratio of TELs losses to decoys, TBM launch rate
  - Blue airbase losses and closures, Blue aircraft losses on the ground, Blue aircraft sorties

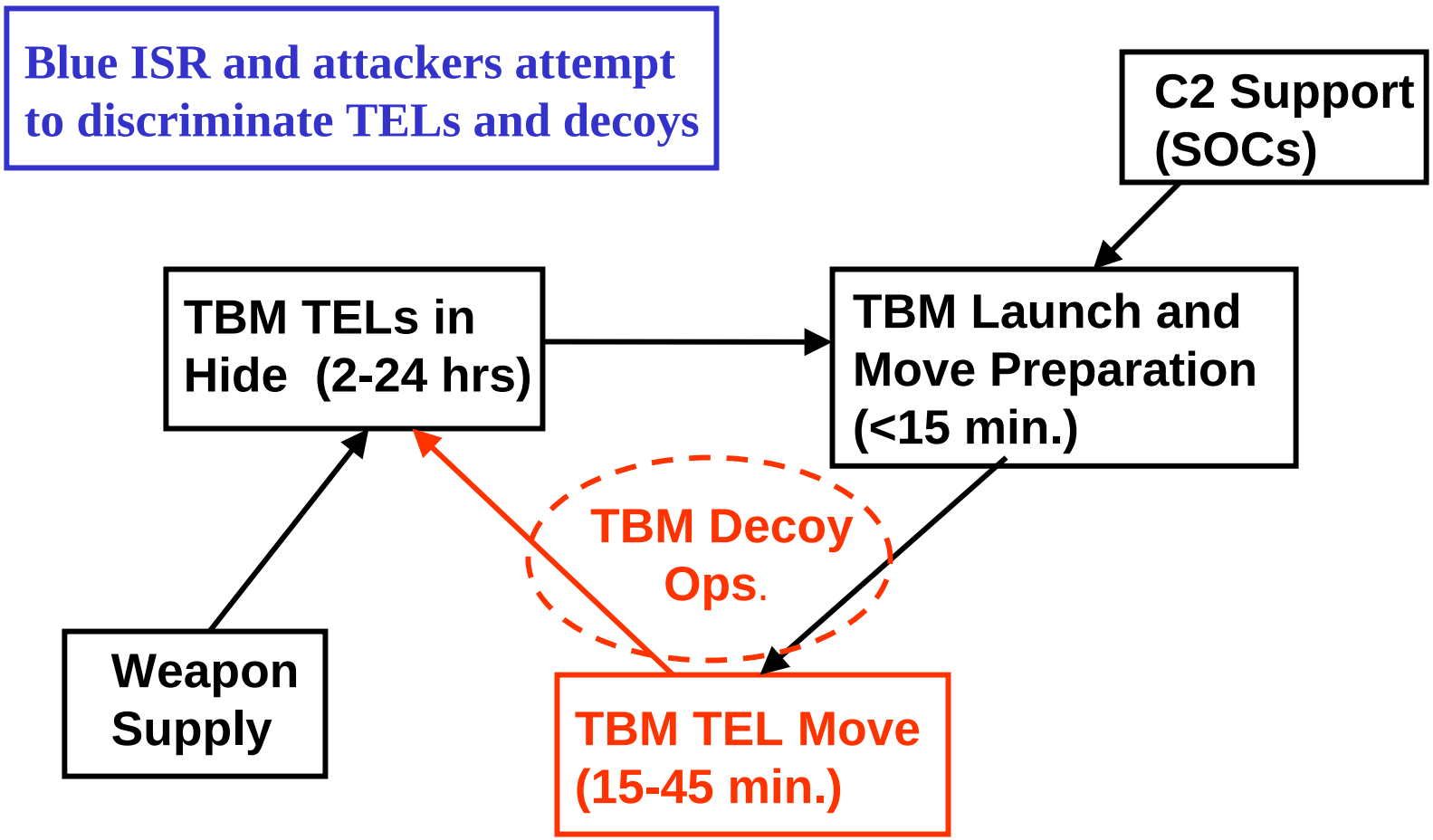
SEAS Theater Level Simulation

"Systems Effectiveness Analysis Simulation"

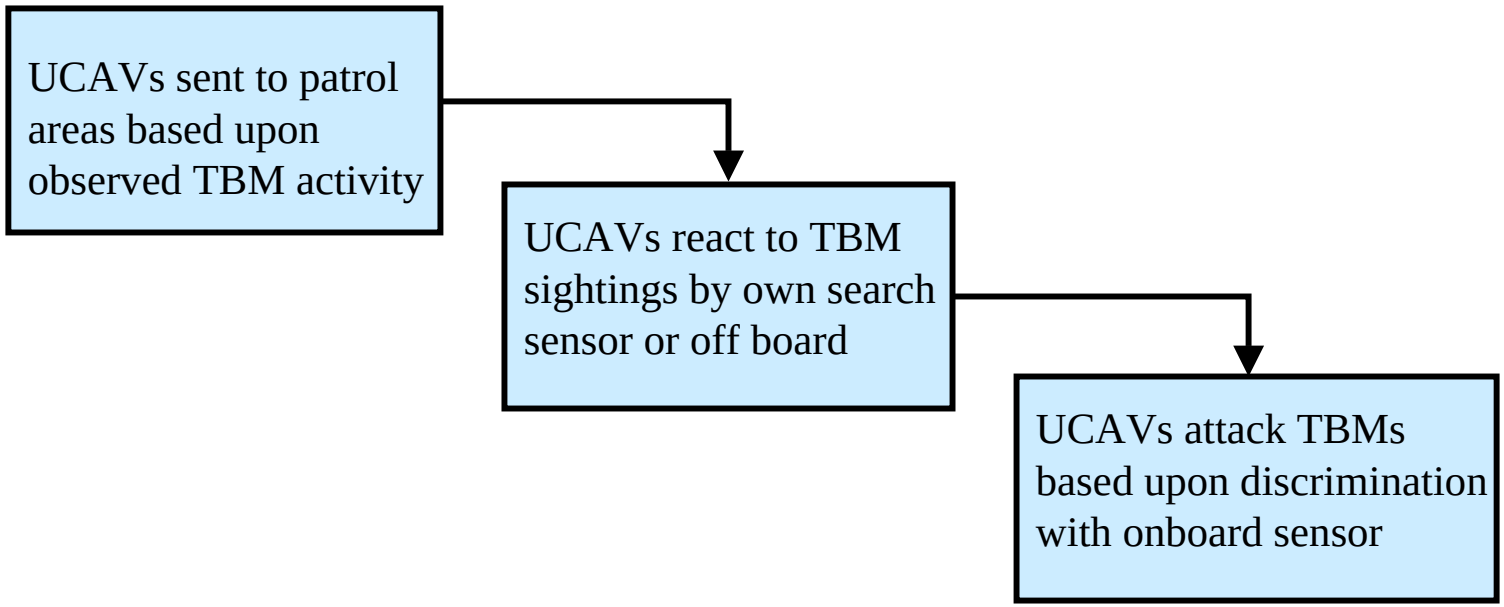
- **Military Utility Analysis of Space, Air, Ground and Sea Systems**
- **Inputs**
  - Military Scenario
  - Military Units & Platforms
  - Sensor & Weapon Performance
  - C4ISR Architectures
- **Outputs**
  - Scenario Outcomes
  - Military Utility Metrics
  - "Killer-Victim" Scoreboard
  - 2D Situational Display
- **Features**
  - Object-Oriented Simulation
  - Monte Carlo Combat Simulation
  - Autonomous Agent Behaviors



Experiment 1 - TBM TELs in Open

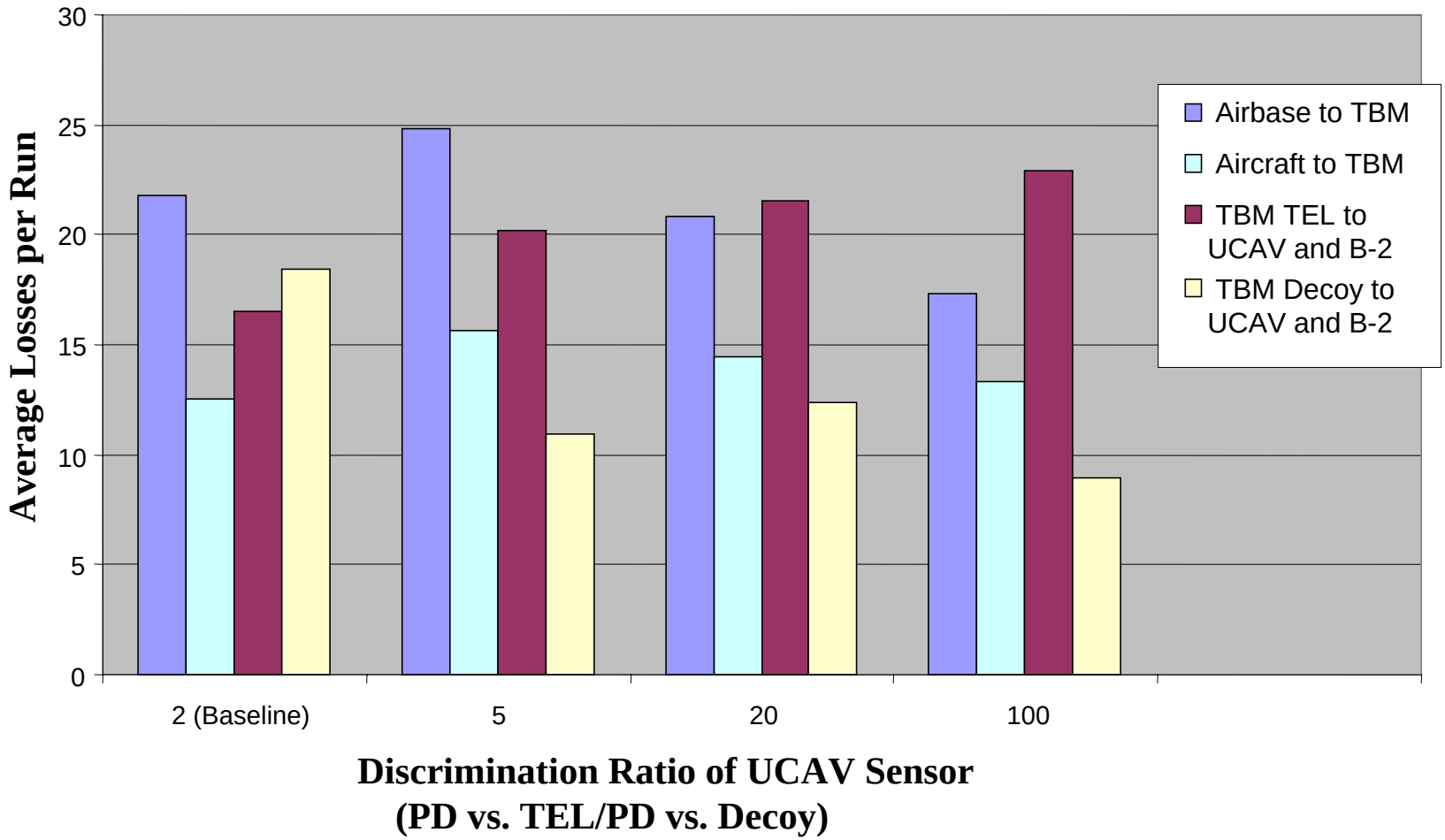


Blue CONOPS - Experiment 1 (Engaging TELs in Open)

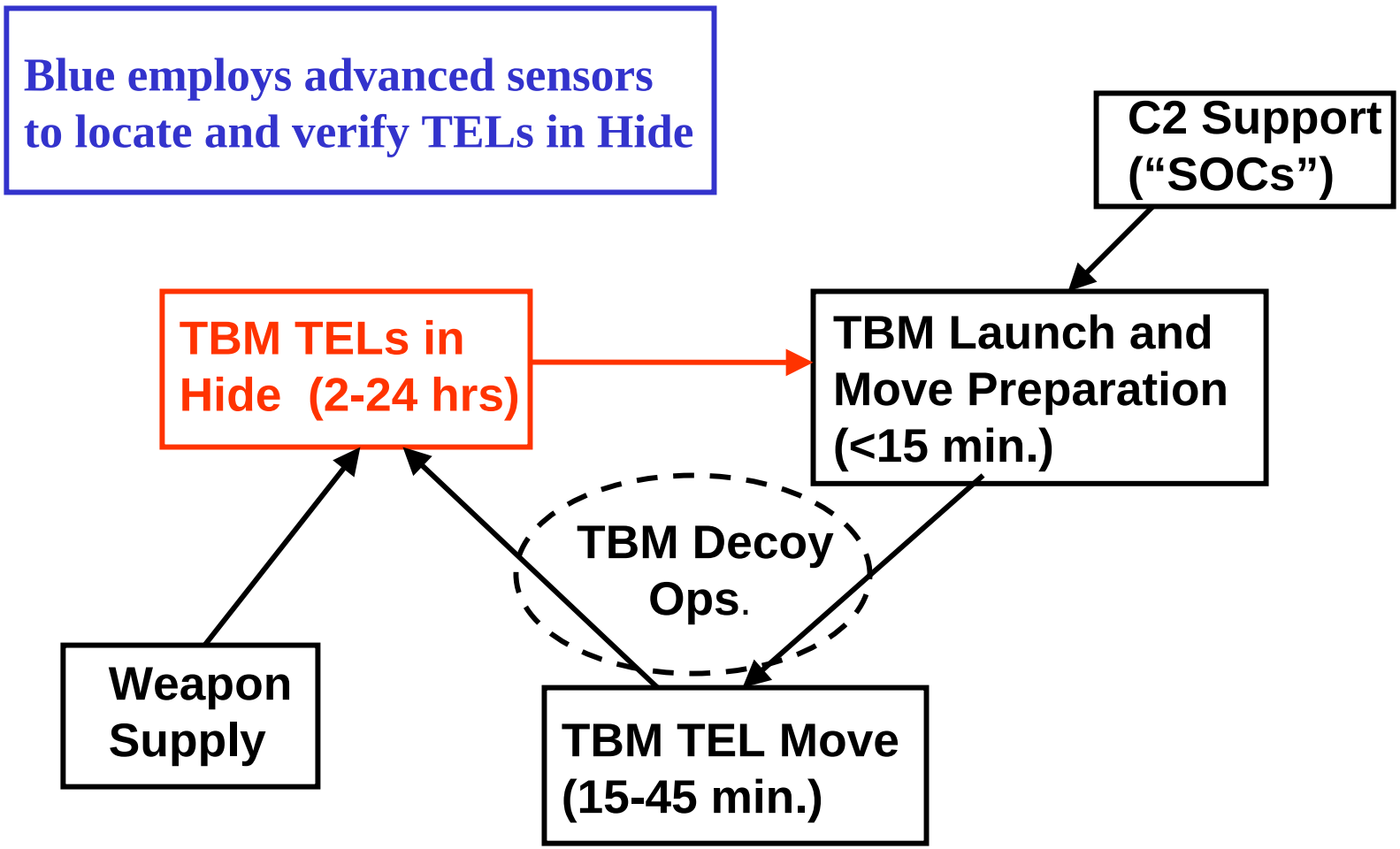


CONOPS options:
1) Cue sensors on overhead platforms (air or space) to help discriminate TELs and decoys;
2) Divert strike missions when available with proper ordnance

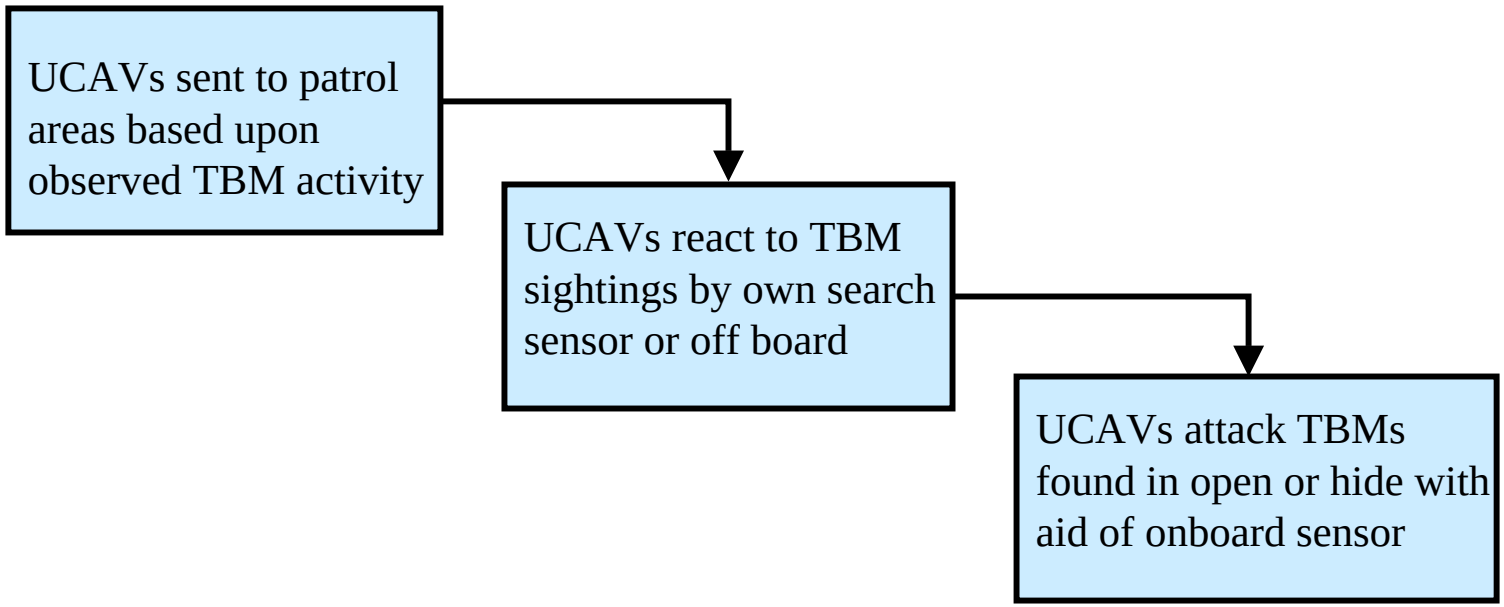
Utility of Sensor Discrimination versus TBM Decoys



Experiment 2- TBM TELs in Hide



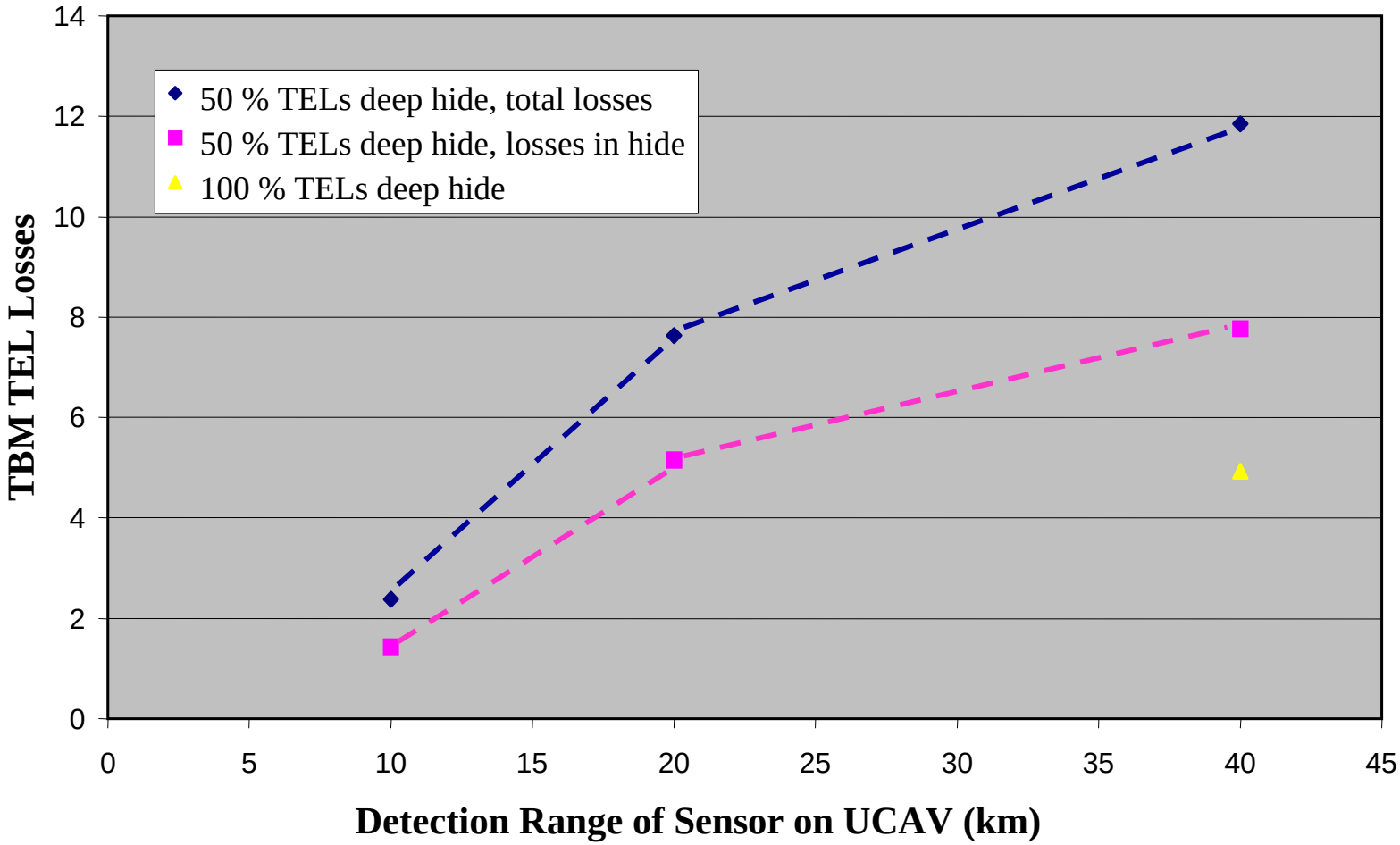
Blue CONOPS - Experiment 2 (Engaging TELs in Hide)



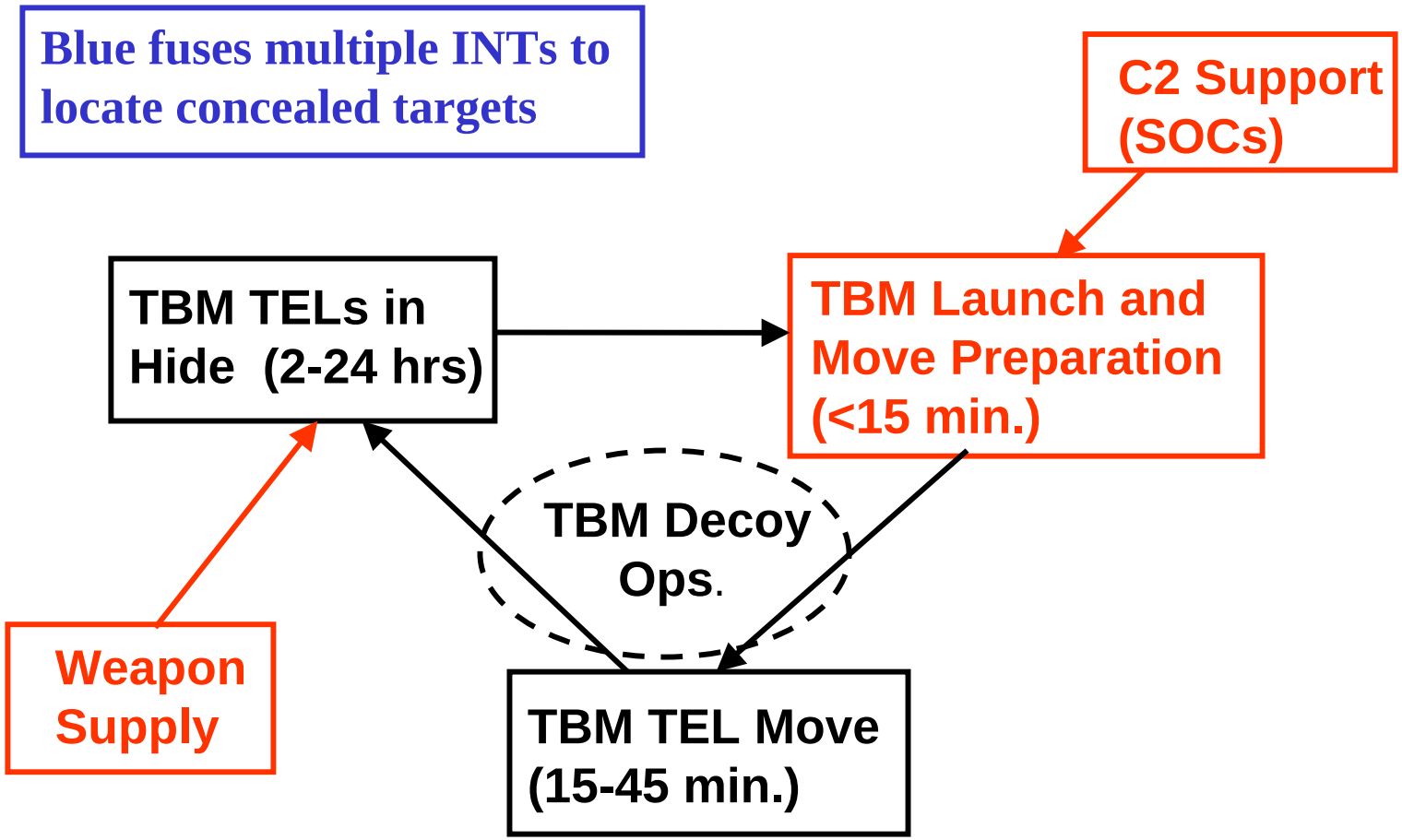
CONOPS options:
1) Cue sensors on overhead platform (air or space) to help locate TBM TELs in hide;

2) Attack TELs in hide with standoff weapons

Operations vs. TBM TELs in Hide



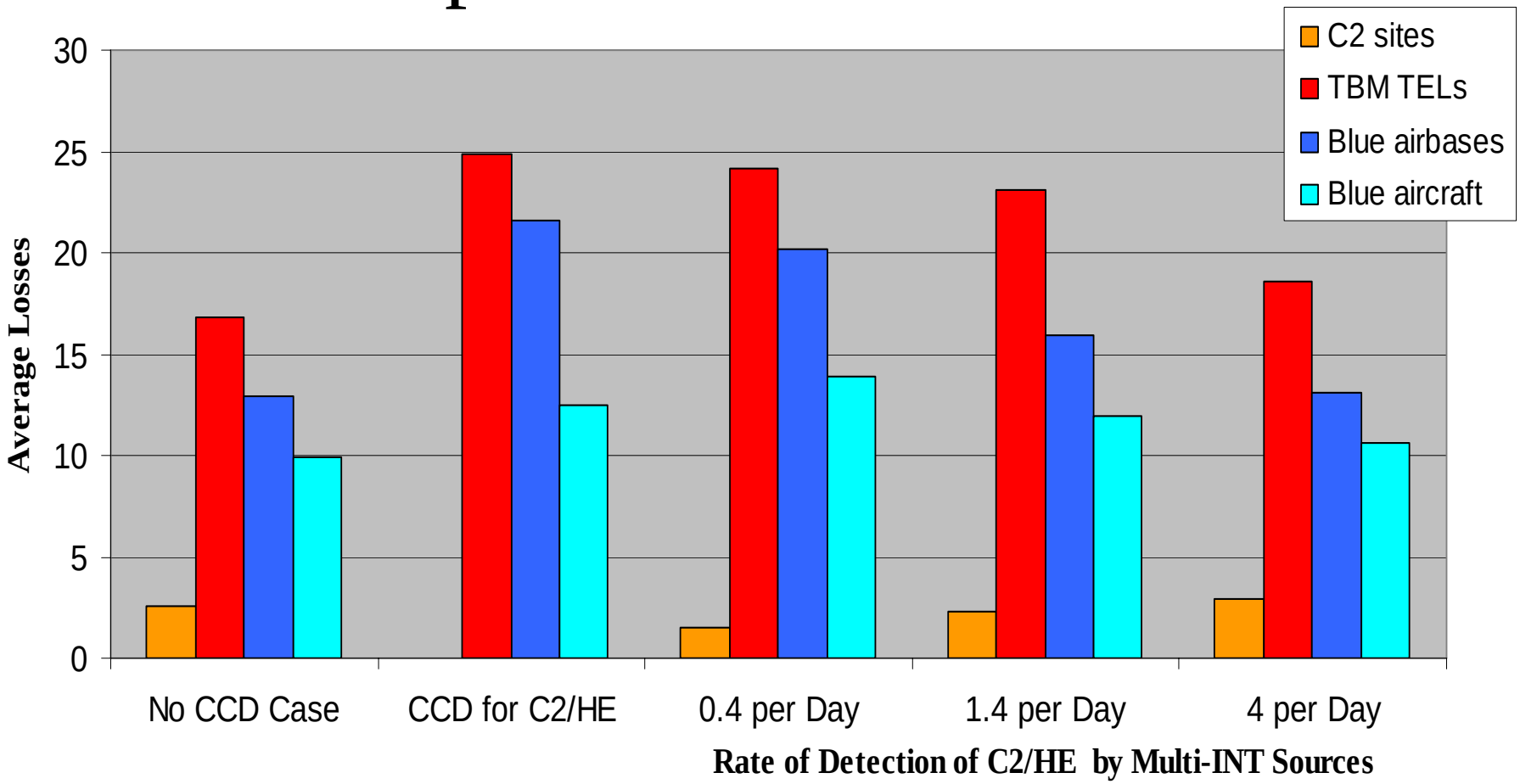
Experiment 3 - Concealed C2 and Weapon Supply Sites



Responsive Blue CONOPS - Experiment 3

- Multiple ISR sources (e.g., SIGINT, HUMINT, GMTI, including IPB) detect and nominate "concealed" Red C2 and weapon supply sites
- Advanced overhead sensors cued to collect imagery for target confirmation
- Advanced weapon systems quickly prosecute attacks
  - Stealthy strike aircraft (JSF, B-2, F-22)
  - UCAV
  - "HyStrike"

Utility of Red Deceptive Tactics and Responsive Blue CONOPS



(Note: no C2 replacement within scenario)

Study Findings

- SEAS agent-based model well suited for representing CCD methods and associated CONOPS for both sides
- Exploratory study ideal vehicle for analyst training
- Choice of utility metrics important for understanding operational and system effects observed in study

- C2 and weapon supply critical for TBM operations
- CCD significantly improves the impact of these threat systems within the scenario
- CONOPS with multiple sources for detection and timely cueing of overhead imagery for target verification can help to counter CCD employment

Backup Slides

Aerospace Military Utility Analysis Roles and Responsibilities

- Assist program offices in assessing the utility impact of alternative concepts, requirements, and design choices
- Explore CONOPS and architecture alternatives for space systems operating together with ground, air, near-space and other space assets
- Participate in operationally based studies to evaluate the contributions of space systems in scenarios for DoD, NRO and Homeland Defense

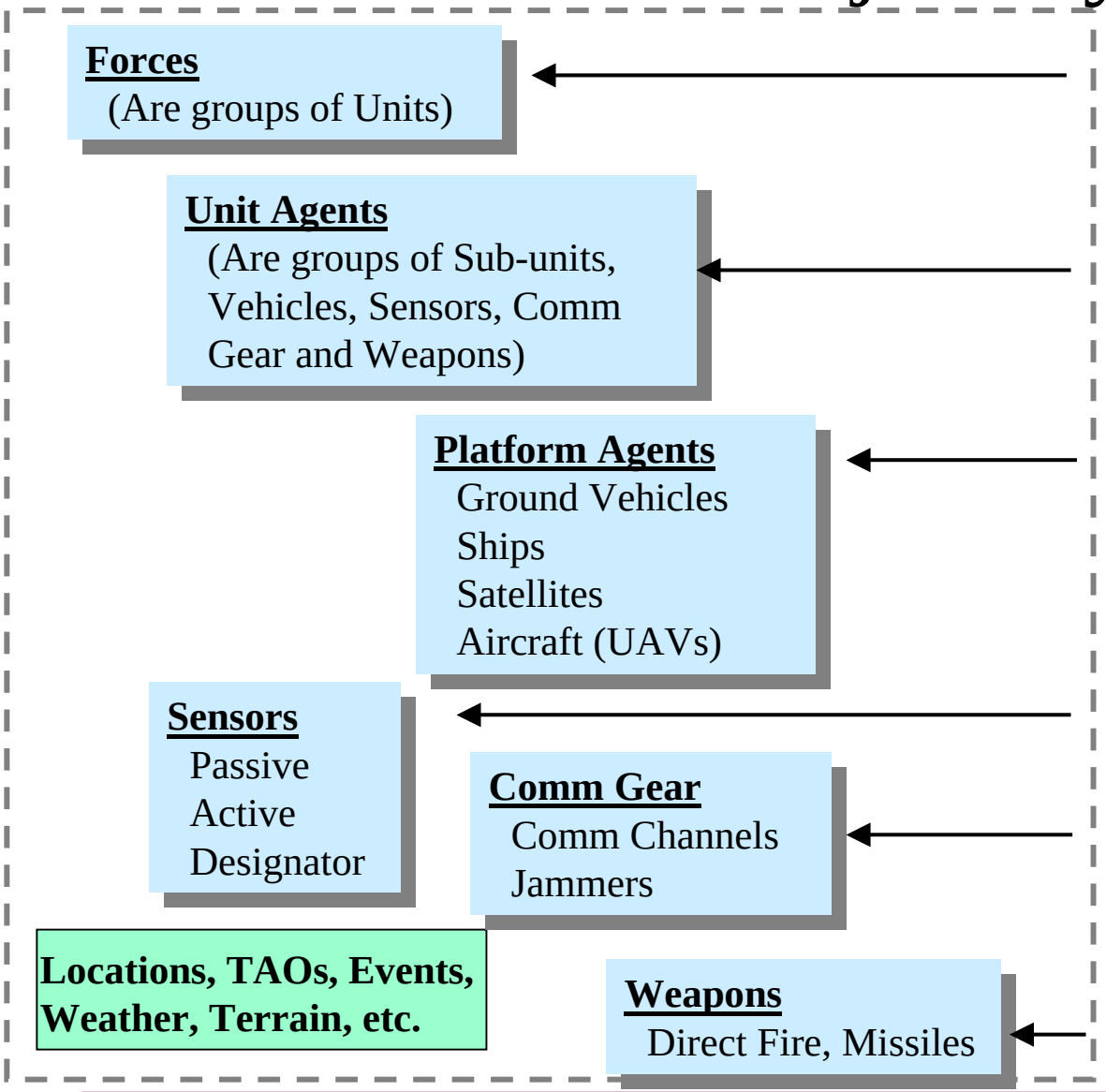
Primary Sources

- "Camouflage, Concealment, and Decoys", Army Field Manual FM 20-3, Headquarters, Department of the Army, 1999
- *www.af.mil*, *www.usmc.mil*, and *www.saab.se* (Saab Defense, Aviation and Space division), for depiction of CCD techniques
- FAS ("Federation of American Scientists"), *www.fas.org*, for weapon system and target information, 2003-04
- *www.teamseas.com*, SEAS website, p.o.c. A. Zinn, Capt., USAF, SMC/TD, 2003-04
- "SEAS 3 Training Presentation", E. Frisco, SPARTA, 2001-02
- "Hyperspectral Imaging", M. Christensen, Lt., USAF, SMC/XREE, 2001
- "Hyperspectral Imaging from Space ", *www.afrlhorizons.com*, Dr. J. Schummers, AFRL, Space Vehicles Directorate, 2003

Some Acronyms

- CCD - Concealment, Camouflage and Deception
- BDA - Battle Damage Assessment
- TBM - Theater Ballistic Missile
- TEL - Transporter-Erector-Launcher
- C2, SOC - Command and Control, Sector Operating Center
- ISR - Intelligence, Surveillance and Reconnaissance
- HSI - Hyper-spectral Imaging
- P_D, P_{ID}, P_K - Probability of Detection, Identification and Kill
- UCAV - Unmanned Combat Air Vehicle
- CONOPS - Concepts of Operations
- SEAS - System Effectiveness Analysis Simulation
- TAO - “Tactical Area of Operation”

SEAS Object Types



Force objects provide initial unit and vehicle spacing, stopping criteria and macro scale movement.

Unit objects provide meso scale movement and command hierarchy for subordinate units and vehicles.

Vehicle objects provide movement in space time for objects that they carry.

Sensor objects provide vehicle and unit detection, position, velocity

Comm Gear (Comm Channels) objects provide target sighting connectivity between vehicles, units and forces

Weapon objects provide vehicle and unit kill capability.

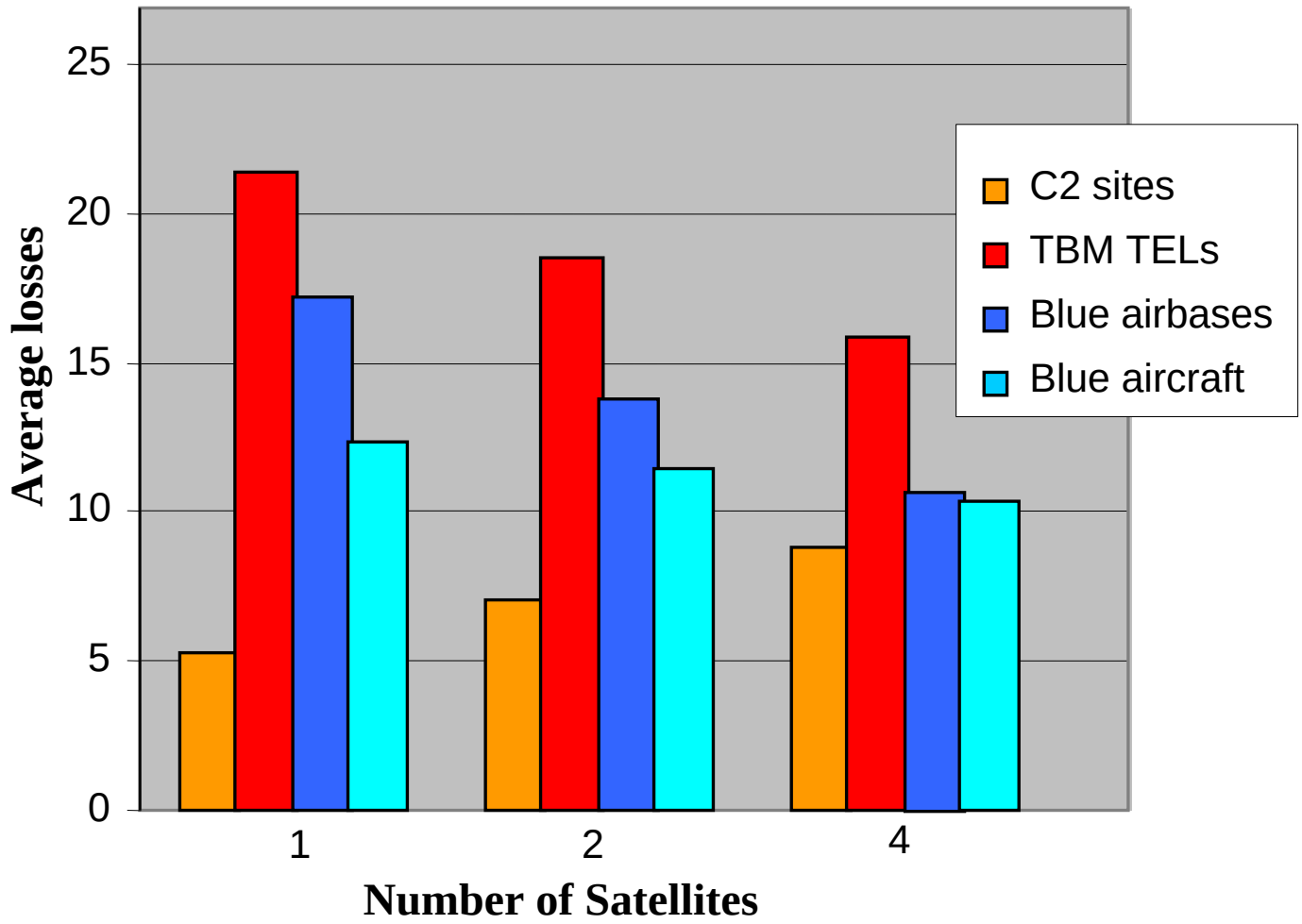
Operate in Urban or Residential Areas

- Summary of tactic
  - Conduct military ops in urban or residential areas
  - Decrease effectiveness of Blue ISR and comm
  - Reduce tempo of Blue operations
- Modeling of tactic in SEAS
  - Create "TAOs" for urban areas where Blue Force sensors have reduced P_D
  - Add delays to Blue C2 decisions for targets located in urban "TAOs"
  - Model civilian entities (optional)
- Metrics
  - Rate of detection and kill against these targets
  - Potential collateral damage

missiles in trailers parked between houses on residential streets

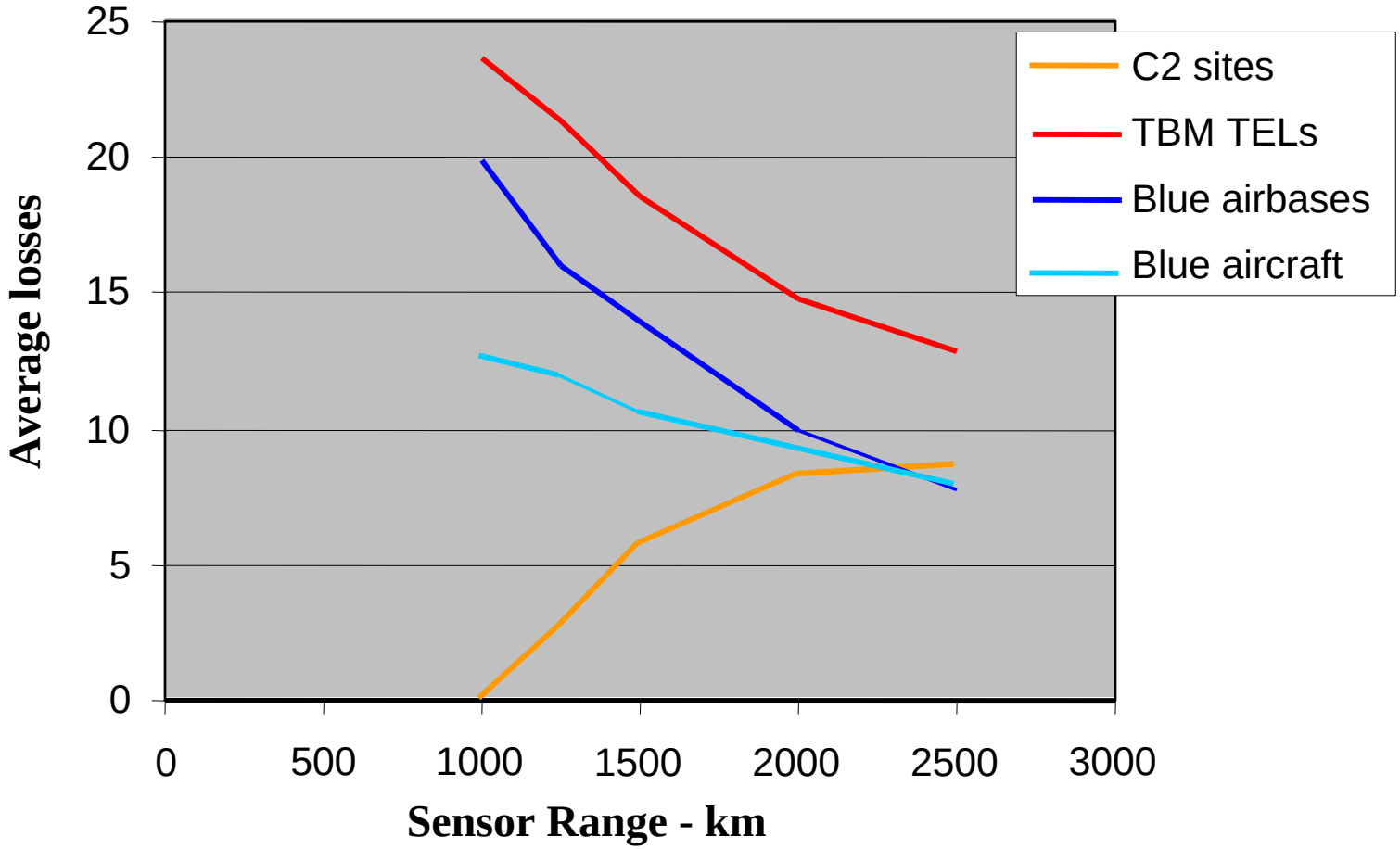
(photos courtesy of USAF, Air Force Magazine)

Sensitivity to Constellation Size



(Note: baseline scenario modified to permit C2 replacement within 12-24 hours)

Sensitivity to Sensor Range



(Note: baseline scenario modified to permit C2 replacement within 12-24 hours)